MULTIFOCAL CONTACT LENS AND METHOD FOR PREPARING

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 040,422 filed Mar. 31, 1993 now U.S. Pat. No. 5,404,183 and a continuation-in-part of application Ser. No. 111,845, filed Aug. 25, 1993.

BACKGROUND OF THE INVENTION

This invention relates to a multifocal hydrophilic ("soft") or rigid gas permeable (RGP) contact lens and method of use in preparing and fitting a customized multifocal contact lens. This invention also relates to a multifocal contact lens (hydrophilic or RGP) produced using such a method.

Bifocal contact lenses are designed to correct or compensate for a condition of advancing age known as "presbyopia." In a presbyopic eye, the ability to focus at near distances, such as the normal reading distance, and in some cases at great distances, is diminished. The loss of focusing capability is due to hardening of the eye's natural crystalline lens material.

Generally, multifocal contact lenses (usually either bifocal, trifocal or aspheric) are concentric or segmented in configuration. In a conventional bifocal contact lens of the concentric type, a first, centrally located, circular correction zone constitutes either distant or near vision correction, while a second annular correction zone surrounding the first zone provides the corresponding near or distance vision correction, respectively. In a conventional bifocal contact lens of the segmented or translating type, the lens is divided into two somewhat D-shaped zones. Usually the upper area is for distant vision correction, whereas the lower area is for near vision correction. Such conventional segmented contact lenses require some sort of movement of the lens relative to the eye to achieve acceptable visual acuity for both distant and near vision.

One accepted method of fitting contact lenses is based on taking so called K readings (which measure the center of the cornea) and fitting the center of the contact lens in a predetermined relationship to those readings. This, however, is not the only method of fitting contact lenses.

In all conventional bifocal fitting techniques, the bifocal or multifocal contact lenses is optimally designed to be particularly positioned on the cornea. However, it is very difficult in many cases, to position the lens to achieve the required fit. In general, the hardest part of fitting a lens is to position the lens at a desired location on the patient's cornea.

Precise fitting of a bifocal contact lens to the eye is crucial in so called simultaneous vision contact lenses where the brain receives both near and far vision input and selects between the near vision input and the far vision input, depending on the desired object(s) of perception.

As mentioned above, the segmented bifocal contact lenses translate to some extent on the eye. Such lenses cannot be locked onto the cornea. However, for good vision, some stability is necessary.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a method for preparing a multifocal soft or hydrophilic contact lens.

Yet another object of the present invention is to provide such a method which utilizes a standardized diagnostic or fitting lens to produce a prescription for a contact lens having an anterior surface containing at least two concentric aspheric surfaces.

Another, more particular, object of the present invention is to provide such a method which is conceptually simple and easy to implement.

A further object of the present invention is to provide a multifocal contact lens which is not necessarily centered in its normal use position(s) on the eye.

Another particular object of the present invention is to provide such a multifocal contact lens which is made from a polymer material which provides at least about 10% by weight water after hydration.

Yet another object of the present invention is to provide such a lens which has at least one spherical or aspheric posterior surface, or a combination of spherical and asperical surfaces.

These and other objects of the present invention may be gleaned from the drawings and detailed descriptions set forth herein.

SUMMARY OF THE INVENTION

The present invention is directed principally to a method for use in preparing a customized soft or hydrophilic multifocal contact lens wherein a standard diagnostic hydrophilic contact lens having a predetermined refractive power for distance vision is first placed on the patient's eye and allowed to seat itself in a natural position. The hydrophilic lens of the present invention will generally seat itself in a substantially centered position (which term shall include a somewhat off-centered position).

In one step of the method, an over-refraction is performed using the diagnostic lens in its natural position on the patient's cornea to determine an aspheric power curve which may be applied to a first portion or area of a prescription multifocal contact lens to provide optimal distance vision for the patient. In another step, a further over-refraction is performed to determine a second aspheric curve to provide near vision for the patient. Generally, the distance vision area is a central area of the lens, while the near vision area is an annular area in the periphery of the anterior surface of the lens.

The patient is fitted with a lens having the same posterior profile as the diagnostic lens and an anterior profile with two or more concentric or coaxial aspheric surfaces having different eccentricity values-as determined by the results of the over-refraction procedure. In accordance with the present invention, the anterior power curve will comprise a minimum of two and a maximum of four aspheric curves, each having different eccentricity values, to provide adequate vision for near, intermediate and far distances. In certain instances, in order to accommodate near, intermediate and distance vision, the lens preferably will comprise central, paracentral and peripheral aspheric curves, each having a different eccentricity value, on the anterior surface of the lens and a single posterior spherical or aspheric curve of predetermined-eccentricity, or optionally and preferably, a spherical curve combined with an aspheric curve of predetermined eccentricity.

Upon placement of a diagnostic hydrophilic contact lens on the cornea of a patient's eye so that the fitting surface is in substantial alignment with the cornea, the diagnostic lens